ONTARIO. MINISTRY OF THE ENVIRONMENT

A report on the solid waste generated in the Hanover-Walkerton area.

1976.

# A REPORT ON THE

# SOLID WASTE GENERATED

# IN THE

# HANOVER-WALKERTON

# AREA

Prepared by the Ontario Ministry of the Environment

1976

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## SUMMARY

This solid waste management study was carried out by the Ontario Ministry of the Environment at the request of the Council of the Town of Hanover.

The report outlines the present state of solid waste generation, collection and disposal within an area centered around the Town of Hanover and the Town of Walkerton. The area of study included the Towns of Chesley, Hanover and Walkerton, the Villages of Mildmay, Neustadt and Paisley and the Townships of Bentinck, Brant, Carrick, Elderslie, Greenock and Normanby.

The report is divided into four sections:

1. Solid Waste Generation,
2. Collection and Disposal Practices,
3. Alternative Methods of Disposal,
4. Economic Evaluation of a Central Disposal Site.

The highlights of each of these aspects of the study are summarized to provide the basis for reviewing the recommendations presented in the study report.

### 1 - Solid Waste Generation

The types and quantities of solid waste generated within the study area are two of the most critical factors to be considered prior to the selection of a waste management system. Estimates were made of the solid waste quantities emanating from each of the municipalities in the study area using a variety of methods. The results indicated that the solid waste generation was found to be closely related to population densities of the various municipalities.

For 1974, the estimated average solid waste production including residential, commercial and industrial waste varied from 1.2 lbs. per capita per day for several of the townships to 6.0 lbs. per capita per day in the Towns of Hanover and Walkerton. The higher solid waste generation in the Towns of Hanover and Walkerton was partially due to industrial waste generated within the towns and the use of the towns' common disposal site by non-residents of Hanover and Walkerton.

The per capita generation rate is expected to increase at an annual rate of 1.5 per cent per year. The Province of Ontario is committed to a program to reduce the amount of waste generated. However, for the purpose of this study, past trends in generation rates as reported in the literature were used to predict future quantities of solid waste.

The population of the study area was 27,525 in 1974. Future development is expected to proceed at a steady rate for most municipalities; however, some centres may experience irregular growths due to the influence of the Bruce Nuclear Power Development. The population of the study area is expected to be 31,360 in 1984 and 35,970 in 1994.

The amount of solid waste generated within the study area and deposited at municipal disposal sites was approximately 14,900 tons in 1974. The projected increase in the per capita generation combined with a parallel increase in the population indicates that the solid waste generated in 1984 may approach 20,130 tons per year and in 1994 may reach 28,270 tons per year.

2 - Collection and Disposal Practices

A review of the collection and disposal facilities was carried out for each municipality in the study area. Information was gathered on the haulers collecting waste, the type of waste collected and the cost to the customers.

Collection services within the study area varied from virtually no collection in the Townships of Bentinck, Brant, Carrick and Greenock to collection at the curb in the towns and villages. Gate pick-up is provided to the majority of residences of the Townships of Normanby and Elderslie. The cost of collection varied from $2.82 to $5.22 per capita per year for those municipalities with contracted disposal services.

Each of the existing waste disposal sites in the study area was visited several times. The physical characteristics, the waste volume received and the acceptability of the disposal operation were categorized for each disposal site.

Virtually all of the solid waste generated is deposited in sanitary landfill sites. Eleven disposal sites serve the twelve communities within the study area with only the Towns of Hanover and Walkerton using a common disposal site. The Hanover disposal site received approximately 70 per cent of the solid waste disposed of in the sanitary landfill sites in the study area.

Most of the municipalities within the study area will be seriously looking for a new disposal site by 1980. While several other sites appear to have longer life expectancies, the presence of ground water and surface water run-off is known to reduce the efficient operation of these sites on occasion.

The cost of disposal for each of the sites was calculated on a population and a tonnage basis. The costs generally reflected the size and efficiency of the operation at the site. The cost of disposal at the Hanover landfill site revealed a lower cost per ton of material disposed of than most of the other sites which indicates a more efficient landfill operation. However, the cost per capita was higher; this higher cost reflected the higher solid waste per capita generation rate for the Towns of Hanover and Walkerton.

3 - Alternative Methods of Disposal

The primary alternatives to sanitary landfill were reviewed and discussed with reference to their applicability to the study area. Some of the methods have proven to be suitable in other locations throughout North America.

The total quantity of refuse generated in the study area was felt to be below the range for economic feasibility of incineration, resource recovery and other disposal processes at this time. However, it was felt that with the possible future development in the areas of recycling and resource recovery and in particular the Provincial Resource Recovery Program, the facility ultimately selected should be capable of accommodating a shift toward the Resource Recovery Program when this becomes a viable alternative to disposal by sanitary landfill for this area.

4 - Economic Evaluation of a Central Disposal Site

By 1980, most of the municipalities in the study area will be seriously looking for a new disposal site. It was decided to outline some of the cost factors that each municipality would encounter in its search for a new site. To determine the economic evaluation of centralizing disposal operations, the cost factors were assembled for individual municipalities establishing their own disposal sites and one large central disposal operation serving all the municipalities. All twelve municipalities were included in the exercise.

The results indicated that significant savings could be realized by most municipalities if they were to use a centralized waste disposal operation. The major area of cost savings included savings with site supervision and the cover-compaction operation.

The higher haulage costs to a central site represented the major economic disadvantage to the creation of a centralized disposal cost. It may be in the best interest of several of the out-lying municipalities to form their own multi-municipal waste disposal operatons. However, because of the complexities of the possible inter-municipal groupings, no economic evaluation was carried out using this approach.

## RECOMMENDED ACTION

By 1980, several of the municipalites in the study area will be seriously looking for a new waste disposal site. If this search process is carried out on an individual municipal basis, each municipality will have to be prepared to encounter significant expenditures to obtain, evaluate and prepare information supporting their proposals for new sanitary landfill sites.

It is felt that a more economical solution to waste disposal within the study area for the immediate future would be accomplished by several municipalities joining together to use their expertise and resources to establish a central waste disposal site. Therefore, it is recommended that a committee be created to initiate the establishment of a central disposal site within the study area to serve at least five municipalities.

It was felt that the most probable initial participants in a central disposal site would include the five municipalities having waste disposal sites which are estimated to reach capacity before or at the same time as the Hanover Disposal Site. In the study area, these municipalities would include the Towns of Hanover and Walkerton, the Villages of Mildmay and Paisley and the Township of Carrick. However, preliminary discussion should involve all the municipalities in the study area outlined in this report.

## PRELIMINARY PLANS FOR A CENTRAL SITE

It is recommended that preliminary meetings be initiated as soon as possible between all the municipalities interested in taking part in a central disposal site.

Included in the discussion at the preliminary meetings should be items including:

(i) the initial participants,
(ii) late entry by other municipalities,
(iii) governing waste disposal committee,
(iv) basis for cost proportioning,
(v) old site closure,
(vi) site location.

It is possible that it may take up to three years to establish a central disposal site. Because the Hanover Waste Diposal Site which receives the majority of the waste in the study area is expected to reach capacity sometime near 1980, it is felt that the preliminary meetings to discuss a central site should be undertaken as soon as possible.

# INTRODUCTION

Over the past several years, the Province of Ontario has been experiencing an increasing rate of growth in the amount of solid waste being generated. This accelerating rate of growth has been closely parallelled by a rise in population, increased demand for consumer goods, and the rising standard of living of people of this Province. Accompanying the increasing amount of solid waste is an intensifying concern by municipal and provincial officials for the problems of the disposal of these wastes. Traditional disposal methods, exemplified by open dumps are no longer socially or legally acceptable in many areas of the Province. Sanitary landfilling, which has replaced open dumping, is the most common method of disposal in Ontario today. However, with the dramatic increase in the costs of suitable land, the stricter requirements of an acceptable disposal operation and greater public opposition to the establishment of disposal sites, municipalities are finding it more difficult to "go-it-alone" and are looking towards area waste disposal sites and exploring other means of solid waste disposal.

Provincial officials are in fact questioning the practice of disposal of waste, for domestic refuse is being viewed as a resource, not to be buried, but to be recycled. Certainly as our natural resources become depleted, the need to reduce the amount of waste generated and recycle what is produced will become more evident.

This report summarizes the present state of solid waste generation, collection and disposal within an area centered around the Town of Hanover and the Town of Walkerton. The report outlines the types of solid waste generated, the volumes of waste presently produced, the expected future increase in the solid waste generated and the predicted quantities, which will require disposal.

Sanitary landfilling is the method of disposal of all of the solid waste generated within the study area. The landfill sites in the study area were examined and an estimate of the quantities of waste landfilled were made. In addition, an appraisal of each site was made with regard to its physical characteristics, adequacy of operation and estimated life expectancy.

Other methods of solid waste disposal were reviewed on the basis of their possible applicability to the study area.

## SCOPE OF THE REPORT

At the request of the Council of the Town of Hanover, this solid waste study was carried out by the Ontario Ministry of the Environment.

The primary objective of the study is to provide recommendations on long range plans for the disposal of solid waste generated in an area centered around the Towns of Hanover and Walkerton. In addition, operational difficulties experienced at the Hanover Waste Disposal Site were to be reviewed and recommendations made to alleviate the problems. During the preparation of this report, procedural changes were made at the site to overcome operational difficulties. Accordingly, recommendations dealing with these procedural changes are not presented; however, comments on the current operation are offered.

The study area selected included the Townships of Brant, Bentinck, Normanby, Carrick, Elderslie and Greenock, the Towns of Hanover, Walkerton and Chesley and the Villages of Mildmay, Neustadt and Paisley. It was postulated that these municipalities within the study area were located sufficiently close to each other that consideration could be given to the use of a single centrally-located disposal site to satisfy the solid waste disposal needs for all of the municipalities. Municipalities not included in the study area were felt to be outside the range for which haulage to a central disposal site could prove economically feasible at this time.

In the study area, data collected on solid waste referred only to those wastes which had been deposited at the municipal landfill sites.

It is the intent of this report to present appropriate recommendations based on a review of the following factors:

1. Solid waste generation in the study area will be examined including the type of waste generated and present and future quantities generated based on population projections available.

2. A description and economic profile of present collection and disposal operations will be detailed along with an outline of the existing landfill sites including location, physical characteristics and operating conditions.

3. A general assessment of alternative means of waste disposal and their applicability within the study area, will be made.

4. An economic comparison of a central disposal site versus individual municipal disposal sites will be carried out.

# 1.0 SOLID WASTE GENERATION

## GENERAL

The types and quantities of solid waste generated within the study area are two of the most critical factors to be considered prior to the selection of a waste management system. In the past, the types and volumes of wastes entering the landfill sites in the study area have not been closely monitored, primarily because of the ease with which additional land could be obtained for this use. However, as the cost of disposal has increased and the supply of land suitable for landfilling has decreased, the importance of obtaining meaningful solid waste data has been evident.

Obtaining data describing the exact physical characteristics and volumes of solid waste is difficult due to the heterogeneous nature of this material and the day to day fluctuation experienced at any one particular landfill site. Estimates present in this report are based on spot checks of site operations, conversations with disposal site operators, municipal officials and waste haulers and through reference to Ontario Ministry of the Environment records. It is felt that the data presented provides a reasonable estimate of existing conditions. More precise estimates would have required conducting a detailed field study which would have involved the use of questionnaires, weigh scales at all disposal sites, and many additional manhours of data collection and interpretation. It is doubtful whether data so obtained would have produced any appreciable change in the findings and recommendations presented in this report.

In order to predict future yearly quantities of solid waste generated to the year 1994, information on presently generated quantities of solid waste were combined with population growth estimates for the subject municipalities. Where assumptions have been made in determining solid waste types and quantities, appropriate explanations are provided.

It should be remembered that the Province is committed to a program, Resource Recovery, which emphasizes the need to reduce the amount of waste generated. The success of this program will alter generation rates; however, for the purpose of this study past trends in generation rates as reported in the literature were used to predict future quantities of solid waste and so should be viewed as conservative estimates.

## 1.1 TYPES AND COMPOSITION OF SOLID WASTE

### 1.1 Types

There are three main types of waste encountered in the study area, these being domestic, commercial and industrial. It was found that for the sites serving rural areas as well as those serving urban areas, a separate determination of the quantities of domestic waste and commercial waste was difficult due partly to the fact that some collection systems combine both types of waste in the same pick-up route. For this reason, solid waste generated per capita is determined from the quantity of domestic and commercial waste.

Industrial waste is not generally directly related to the population of the area serviced by a waste disposal site and accordingly the quantities are usually reported separately.

Other types of waste include construction and demolition waste, wood wastes (brush, tree stumps and Christmas trees), bulky wastes not normally picked up during the regular collection (appliances and furniture), agricultural waste (fence wire and seed cleanings) and street and sewer cleanings.

Wastes such as hospital wastes, derelict motor vehicles and liquid wastes are disposed of by methods other than sanitary landfilling and accordingly are not included in this study.

Table 1-1 shows the types of waste generated in each municipality within the study area, based on observations and disposal site records. As can be seen, the solid waste generated in the Towns of Hanover and Walkerton contained more industrial wastes than the other municipalities. The industrial wastes originated primarily from furniture factories in these two towns. As would be expected, the waste generated in the rural townships and villages was predominantly residential and commercial.

TABLE 1 - 1

TYPES OF SOLID WASTE GENERATED IN STUDY AREA

TYPE OF SOLID WASTE
(Approximate Percentage of Total)

| Municipality | Residential and Commercial | Industrial | Other[1] |
|---|---|---|---|
| **Towns** | | | |
| Hanover-Walkerton | 70 | 20 | 10 |
| Chesley | 90 | 2 | 8 |
| **Villages** | | | |
| Mildway | 90 | 2 | 8 |
| Neustadt | 90 | 2 | 8 |
| Paisley | 90 | 2 | 8 |
| **Townships**[2] | 90 | 1 | 9 |

1 includes construction, tree, bulky, agricultural wastes
2 includes Bentinck, Brant, Carrick, Elderslie, Normanby

### 1.1.2 Composition

Numerous studies have been made of the constituents of municipal refuse (domestic and commercial) and ranges of percentage composition have been established as shown in Table 1-2.

TABLE 1 - 2

EXPECTED COMPOSITION RANGES IN MIXED MUNICIPAL WASTES

| Materal | Percent Composition as Received* (Dry Weight) |
|---|---|
| Paper and Paper Products | 37 - 60 |
| Food and Vegetation | 12 - 18 |
| Metals | 7 - 10 |
| Glass and Ceramics | 6 - 12 |
| Wood | 1 - 4 |
| Others including plastics | 6 - 16 |
| Rags etc. | |

*The moisture content is usually 20 - 40%.

A review of Table 1 - 2 indicates that the bulk of municipal refuse is made up of paper and paper products such as cardboard. In some municipalities in the study area such as the Town of Hanover the wood waste represented a higher percentage than that indicated in Table 1 - 2.

The make-up of the municipal waste at any particular landfill site is dependent on the living style of the community served. For example, those sites, which serve primarily rural areas undoubtedly would be lower in paper products than the urban sites due to the greater use of wood burning stoves in rural area.

To obtain exact figures for the percentage composition of refuse from all the municipalities in the study area, would be a long term project of little value to the purpose of the report. While it is important to know the composition of the waste, especially if hazardous wastes are involved, the overall quantities of waste are of the most importance to this study.

The composition of industrial waste is wholly dependent on the type of industry using the waste disposal site. In the study area, by far the largest quantities of industrial waste are received at the Hanover waste disposal site. This industrial waste is mainly composed of wood and wood by-products (veneers) from the furniture manufacturing plants within the Towns of Hanover and Walkerton.

## 1.2 SOLID WASTE GENERATION RATE

Solid waste generation rates are expressed in this report in terms of pounds per capita per day (lbs/c-d). The year 1974 was used as the reference year for most calculations.

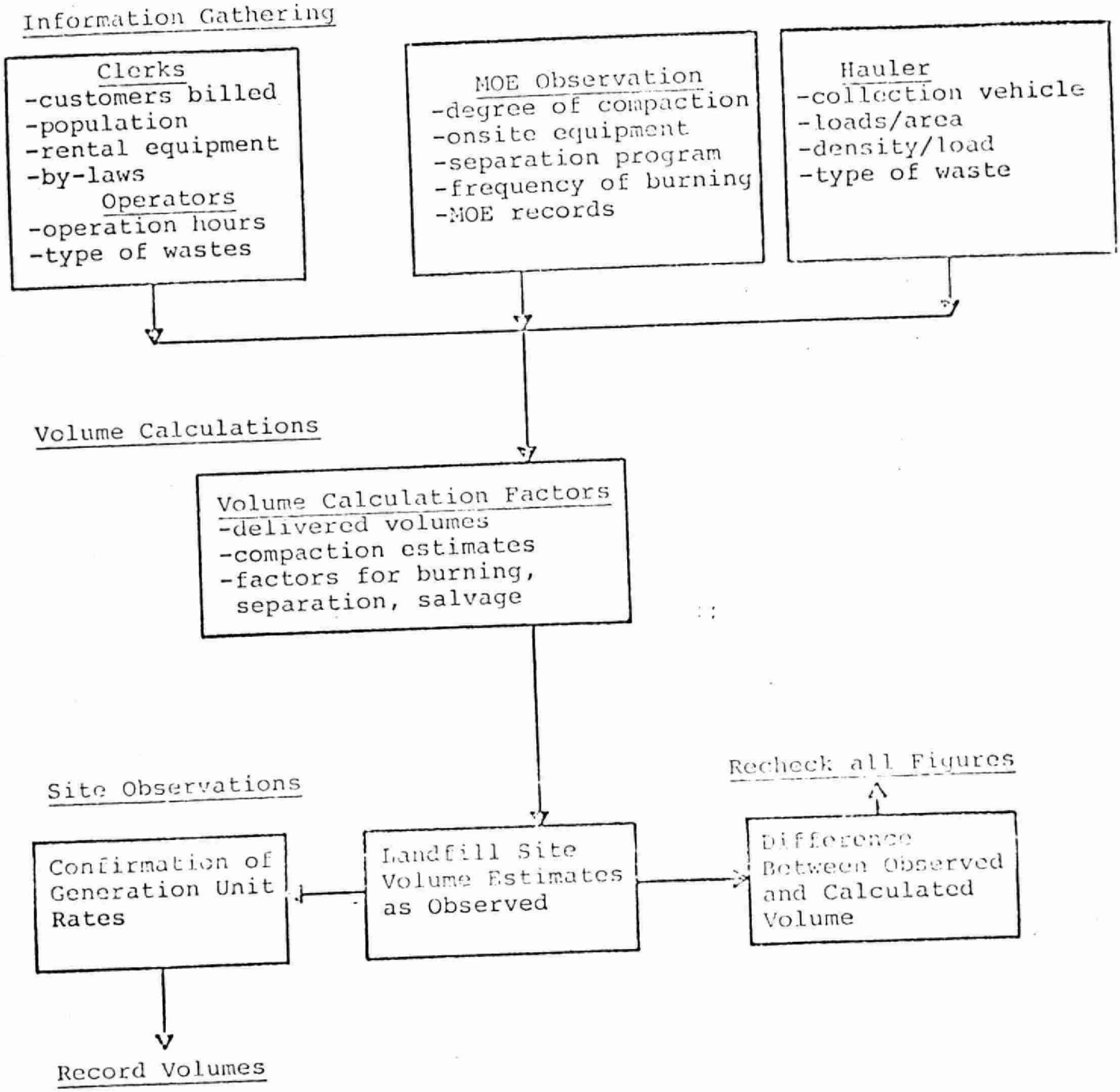
An attempt was made to determine a solid waste generation rate for each municipality within the study area.

Establishing the generation rate for each municipality involved three steps:

1. information gathering,
2. weight-volume calculations,
3. confirmation by observation.

FIGURE 1 - 1

FLOW DIAGRAM FOR DETERMINING SOLID WASTE VOLUMES



The three stage program is depicted pictorially in Figure 1 - 1. Essentially, as much information was gathered about each disposal site and municipality as possible. Using this information, a calculated estimate was made of the monthly waste volume generated. This volume was then compared to the volume as observed over a given period of time at the disposal site (anywhere between two months to one year). If the volumes were found to be within 10 - 15 per cent, then the calculated waste generation rate was considered to be a fair estimate. If the calculated and observed waste volumes were not close, the situation was completely reviewed until confirmed data could be established. In most cases alterations were found to be slight or not necessary.

Volume estimates are not very meaningful when used as a statistic for refuse quantity determinations, because of the varying compaction of the refuse. For this reason, the waste volumes were converted into weight (tonnages). At most landfilling operations, the waste when compressed and covered at the site has a density from 500 to 1,000 lbs. per cubic yard. The density is subject to factors such as the type of waste and the landfilling equipment available at the site. For each disposal site, within the study area, a volume-to-weight calculation was applied to determine the total weight of waste deposited at the site.

With the exception of the Town of Walkerton which uses the Hanover waste disposal site and the Village of Mildmay which uses the Carrick waste disposal site on Lot 11, Concession 6 and 7, each municipality has its own waste disposal site. Accordingly, the weight (tonnage) of waste deposited at each of the disposal sites was felt to be representative of the municipality served except as noted below. The per capita waste generation rates were then calculated based on the population of the municipality.

The Township of Carrick disposal site, at Lot 11, Concession 6 and 7 was considered to be serving a total population of 2,902. This population was made up of 1002 residents from the Village of Mildmay and approximately 1,900 people from the Township of Carrick. The Township of Carrick, Carlsruhe disposal site, was estimated to be serving approximately 600 people from the Township of Carrick in and around the Carlsruhe area. The waste generation rate for the Township of Carrick, as calculated for the Carlsruhe site, was applied to the township population using the Mildmay site. The weight of refuse deposited at the Mildmay disposal site by township residents was then calculated and subtracted from the total waste weight. The resulting difference in weight at the Mildmay site is felt to be attributable to the residents of the Village of Mildmay.

The Towns of Hanover and Walkerton use a common disposal site in the Township of Brant near the western limits of Hanover. There was no attempt to calculate the individual generation rates for the Town of Hanover and the Town of Walkerton since this would have involved a prohibitively lengthly study. In 1974 the weight of the solid waste deposited at the Hanover disposal site based on hauler records was calculated to be approximately 6.5 tons/day less than the weight estimated by on-site observations. This was equivalent to 1.4 lbs/c-d for the residents of the Towns of Hanover and Walkerton.

A re-checking of the calculations indicated that the calculated volumes were fairly accurate and that the difference was attributable to other factor(s). The difference was finally attributed to:

1. use of the site by non-residents of Hanover and Walkerton,

2. unaccounted industrial waste haulers.

The fact that the Hanover disposal site was open six days per week while neighbouring disposal sites were open one or two days each week as well as there being no user charge were the probable reasons for the use by residents outside of Hanover and Walkerton.

It should be noted that since 1976, controlled access has been carried out with the result that the amount of waste received at the Hanover-Walkerton site has decreased. Rather than determining the re-distribution of the waste throughout the study area it is felt that the primary purpose of this study can still be achieved using 1974 field data. The generation rates for Hanover and Walkerton must be qualified however, by noting that 6.5 tons/day or 1.4 lb/c-d is not generated within those towns but probably originates within the study area.

The solid waste generation rates for all the municipalities within the study area for 1974 are summarized in Table 1 - 3. It should be noted that these generation rates were felt to be representative of the solid waste that was landfilled at the disposal sites. The estimates do not include non-industrial wood waste or in the case of the Hanover disposal site, industrial wood waste both of which are disposed of by open burning.

A review of Table 1 - 3 indicates that the Hanover-Walkerton area had the highest solid waste generation rate of all the municipalities in the study area. The reasons include a higher domestic and commercial waste generation rate as well as a significant input of industrial waste. Industrial waste was not felt to represent a significant amount of the waste deposited at any other disposal site.

The villages contributed approximately the same amount of waste on a per capita basis. The difference in the per capita generation rate between the towns and villages was felt to be due primarly to less commercial and industrial waste in the Villages.

The per capita waste generation rate for the townships were proportionately lower than any of the villages and towns. The reasons were throught to include the greater use of wood stoves, eliminating much of the paper waste, the use of garden produce (thus decreasing the waste volumes generated from packaging associated with store bought goods), and the use of compost piles. In addition, little commercial waste was evident at any of the township disposal sites.

The variation of the per capita waste generation rates between the townships was due to the presence and extent of collection services and a variation in the amount of agricultural waste received.

In summary, the range of solid waste generation rates within the study area was 1.2 to 6.0 lbs/capita/day. These findings are similar to studies carried out in other areas of Ontario. For example, the following waste quantities have been reported in the literature.

| | |
|---|---|
| North America Range | 2-11 lbs/c-d |
| City of Sudbury | 4.2 lbs/c-d |
| Smaller areas within the Sudbury Region | 3.6-3.8 lbs/c-d |
| Lanark County | 1.7-2.5 lbs/c-d |
| Hastings County | 2-5 lbs/c-d |
| Metropolitan Toronto | 4.6 lbs/c-d |

TABLE 1 - 3

1974 SOLID WASTE GENERATION RATES

| Municipality | Waste Generation Rate (lbs/capita/day) Domestic Commercial | Industrial[1] | Other[2] | Total[3] |
|---|---|---|---|---|
| **Towns** | | | | |
| Hanover | 3.2 | 1.4 | 1.4 | 6.0 |
| Walkerton | 3.2 | 1.4 | 1.4 | 6.0 |
| Chesley | 1.8 | --- | --- | 1.8 |
| **Villages** | | | | |
| Mildmay | 1.77 | --- | --- | 1.75 |
| Neustadt | 1.8 | --- | --- | 1.8 |
| Paisley | 1.8 | --- | --- | 1.8 |
| **Townships** | | | | |
| Bentinck | 1.2 | --- | --- | 1.2 |
| Brant | 1.3 | --- | --- | 1.3 |
| Carrick | 1.2 | --- | --- | 1.2 |
| Elderslie | 1.3 | --- | --- | 1.3 |
| Greenock | 1.2 | --- | --- | 1.2 |
| Normanby | 1.2 | --- | --- | 1.2 |

1. see text regarding burning practices
2. unaccouted for waste (non-resident)
3. represent landfill waste only.

## 1.3 GROWTH OF THE SOLID WASTE GENERATION RATE

It is difficult to predict the future per capita generation rate of solid waste. Past records of waste quantities have been for the most part incomplete. Future generation rates are subject to several factors, most important of which include:

1. government legislation restricting waste generation,
2. alternative methods of packaging,
3. technological developments in collection and haulage,
4. public concern over depletion of natural resources.

Published data indicate that the growth of the generation rates for residential and commercial waste, the bulk of the waste in the study area, could range from 1.5 to 3 per cent per year. Similar estimates have been made for the other types of waste. The conservative estimate of growth at 1.5 per cent per year was chosen and applied to the waste generation in the study area. It was felt that a combination of government legislation, public education and rising commodity prices would all contribute to keeping the growth rate of the per capita generation rate at a relatively low level over the next 20 years.

Using the 1.5 per cent rate of growth per year, the growth in per capita generation rate for each municipality in the study area was established as shown in Table 1 - 4.

The urban areas of Hanover and Walkerton should expect their daily waste quantities per capita to increase from 6.0 to 8.1 lbs. between 1974 and 1994. The rate of increase in the other areas will be somewhat less in terms of weight per capita per day; however, the increased percentage will be the same.

TABLE 1 - 4

SOLID WASTE GENERATION RATE PROJECTIONS

| Municipality/Year | Generation Rate Projections (lbs./capita-day) | | |
|---|---|---|---|
| | 1974 | 1984 | 1994 |
| Towns | | | |
| Hanover | 6.0 | 6.9 | 8.1 |
| Walkerton | 6.0 | 6.9 | 8.1 |
| Chesley | 1.8 | 2.1 | 2.4 |
| Villages | | | |
| Mildmay | 1.75 | 2.0 | 2.35 |
| Neustadt | 1.8 | 2.1 | 2.4 |
| Paisley | 1.8 | 2.1 | 2.4 |
| Townships | | | |
| Bentinck | 1.2 | 1.4 | 1.6 |
| Brant | 1.3 | 1.5 | 1.75 |
| Carrick | 1.2 | 1.4 | 1.6 |
| Elderslie | 1.3 | 1.5 | 1.75 |
| Greenock | 1.2 | 1.4 | 1.6 |
| Normanby | 1.2 | 1.4 | 1.6 |

## 1.4 POPULATION GROWTH IN THE STUDY AREA

The quantity of solid waste is closely related to the population. This is particularly true for domestic and commercial wastes. In reviewing the population growth for the study area, several sources were consulted. These sources included past population records, planning studies and estimates found in reports on utility expansions such as water and sewage.

A summary of the findings is presented in Table 1 - 5. A composite growth percentage for the years 1974 - 1994 was formulated from all the reports reviewed. The growth in the municipalities was expected to vary from 1 to 2.5 per cent per year. The population growth patterns for several communities including Walkerton, Chesley and Paisley may be irregular due to the influence of the Bruce Nuclear Power Development (BNPD). Population projections for the townships were difficult to make. The Township of Brant has grown steadily over the past 10 years, while the other township's populations have remained relatively constant. The Townships of Bentinck, Brant and Elderslie were expected to experience most of the population growth. The other townships were allotted a nominal 0.3 per cent annual growth rate. The population within the study area is expected to increase from the 1974 level of 27,525 to 35,970 in 1994.

## 1.5 SOLID WASTE QUANTITIES - PRESENT AND FUTURE

The factors of the population, refuse generation rate per capita and the growth patterns of each have been combined to determine the present and future solid waste quantities in the study area. This is shown in Table 1 - 6.

A review of this table indicates that the total solid waste generation in 1974 was 14,900 tons. This figure is expected to rise over the next twenty years to 28,270 tons. The Town of Walkerton is expected to experience the largest increase in solid waste quantities in the study area primarily due to its having the highest predicted population growth rate in the study area.

Solid waste generation in the townships, excluding the Townships of Brant and Elderslie is expected to rise approximately forty per cent over the next twenty years.

TABLE 1 - 5

STUDY AREA POPULATION GROWTH PATTERNS

| Municipality /Year | 1956[1] | 1966[1] | 1974[2] | 1984[3] | 1994 | Average Annual Percent Increase 1974 - 1994 |
|---|---|---|---|---|---|---|
| Towns | | | | | | |
| Hanover | 3943 | 4665 | 5113 | 5930 | 6870 | 1.5 |
| Walkerton | 3698 | 4380 | 4409 | (5400) | 7220 | 2.5 |
| Chesley | 1629 | 1686 | 1755 | (2250) | 2600 | 2.0 |
| Villages | | | | | | |
| Mildmay | 870 | 943 | 1002 | 1250 | 1490 | 2.0 |
| Neustadt | 490 | 564 | 531 | 650 | 790 | 2.0 |
| Paisley | 739 | 698 | 947 | (1080) | 1270 | 1.5 |
| Townships | | | | | | |
| Bentinck | 2136 | 2350 | 2360 | 2700 | 2880 | 1.0 |
| Brant | 2695 | 2772 | 3389 | 3740 | 4130 | 1.0 |
| Carrick | 2522 | 2562 | 2503 | 2580 | 2660 | 0.3 |
| Elderslie | 1259 | 1194 | 1250 | 1380 | 1520 | 1.0 |
| Greenock | 1861 | 1663 | 1775 | 1830 | 1890 | 0.3 |
| Normanby | 2516 | 2353 | 2491 | 2570 | 2650 | 0.3 |
| Totals | 25358 | 25830 | 27525 | 31360 | 35970 | 1.3 avg. |

1 Statistics Canada
2 1975 Municipal Directory
3 ( ) irregular growth due to BNPD

## 1.6 DISCUSSION

As stated at the beginning of this section, the amount and types of solid waste are two of the most important facets of a waste management study. In this section a rough breakdown of the various types of wastes expected in the different municipalities was outlined. The description of the types of waste were based on field observations and conversations with area waste disposal personnel. These descriptions should not be viewed as static but as subject to variation over the next twenty years. Similarily, the weight estimates of solid waste currently produced and projected over the next twenty years should be reviewed with full knowledge that they are subject to change as outlined in this section.

In summary, the solid waste generation is expected to grow with the population as well as to increase on a per capita basis over the next twenty years. The 1974 solid waste quantity of 14,900 tons in 1974 is expected to rise to 28,270 tons in 1994. This situation obviously warrants long term planning if the disposal of this waste is to be carried out in an economical and acceptable manner.

The assessment of the existing landfill sites and the alternative means of solid waste disposal are discussed in the following sections with reference to their applicability to any long range plans for the study area.

TABLE 1 - 6

SOLID WASTE QUANTITIES 1974 - 1994

| Municipality/ Year | Weight of Solid Waste (Tons/Year*) | | |
|---|---|---|---|
| | 1974 | 1984 | 1994 |
| Towns | | | |
| Hanover | 5,600 | 7,470 | 10,160 |
| Walkerton | 4,830 | 6,800 | 10,670 |
| Chesley | 580 | 860 | 1,140 |
| Villages | | | |
| Mildmay | 310 | 460 | 640 |
| Neustadt | 170 | 250 | 350 |
| Paisley | 310 | 410 | 560 |
| Townships | | | |
| Bentinck | 520 | 690 | 840 |
| Brant | 800 | 1,020 | 1,320 |
| Carrick | 550 | 660 | 780 |
| Elderslie | 300 | 380 | 490 |
| Greenock | 380 | 470 | 550 |
| Normanby | 550 | 660 | 770 |
| Totals for Study Area | 14,900 | 20,120 | 28,270 |

* All weights rounded off to nearest 10 tons.

# 2.0 EXISTING SOLID WASTE COLLECTION PRACTICES AND DISPOSAL FACILITIES

## GENERAL

A review of the current collection practices and disposal facilities was carried out for each municipality in the study area.

Information was gathered on the collection service including the haulers collecting waste, the type of waste collected and the cost to the customers.

Each of the existing waste disposal sites in the study area was visited several times. The physical characteristics, the waste volume received and the acceptability of the disposal operation was categorized for each disposal site. In addition, the associated operating costs for disposal were calculated on a per capita and a per weight basis.

## 2.1 PRESENT COLLECTION PRACTICES

The solid waste haulers in the study area were interviewed to help in establishing which municipalities and in what areas solid waste is collected, the firms collecting the waste, the approximate cost of collection, and the disposal site used.

Collection services within the study area varied from virtually no collection in the Townships of Bentinck, Brant, Carrick and Greenock to collection at the curb in the towns and villages. Gate pickup is provided to the majority of residences of the Townships of Normanby and Elderslie. However, in a few cases, residences that are located a considerable distance from the main pickup route, are required to transport their refuse to the closest point on the pickup route for collection by the municipal contractor.

Approximately 9,500 to 10,000 people out of a total population of 27,525 people in the study area did not have collection services.

All the towns and villages in the study area have domestic and commercial collection services. In each case, a municipal contract was awarded to collection firm(s). Municipal contracts also exist in the Townships of Normanby and Elderslie.

Private domestic collection takes place in several hamlets with this service based on an agreement directly between the customer and the collection firm. Some commercial establishments have also made arrangements directly with collection firms where the municipal collections do not completely meet their requirements.

A summary of the services provided in the study area during 1974 and early 1975 is shown in Table 2 - 1. At the time of the study, Scarlett Waste Disposal Service formerly Grey - Bruce Sanitary Collection Services served the Towns of Hanover and Walkerton. McLellan Disposal Services had the collection contract for the Townships of Elderslie and Normanby as well as the Town of Chesley. The Town of Chesley also provided partial municipal collection on a once a week basis to commercial firms located in the business core.

The Villages of Mildmay, Neustadt and Paisley used the services of C. Halin, R. Seip and A. Cormack respectively. Mr. B. Baetz serviced the Hamlets of Marl Lakes, Elmwood and the area just north and east of Hanover. Mr. H. Bester handled the solid waste pickup for Cargill and Chepstow.

The residents just north and east of Hanover, who were provided with collection service were billed directly by the Township of Bentinck. The private contractor providing this service was paid the amount collected by the township. A similar situation existed for the Hamlets of Elmwood and Marl Lakes.

Formosa residents used the Teeswater disposal site under an agreement by the Township of Carrick. The residents are billed directly by the Township of Carrick for this service.

Chepstow residents used the Greenock Township Disposal Site under an agreement arranged between the residents and Mr. H. Bester, who provided the private collection services with no municipal involvement at all.

### 2.1.1 Collection Costs

Table 2 - 1 also outlines the costs of collection services for each of the municipalities. The costs outlined are for 1974 with the exception of the Township of Normanby. Collection commenced in the Township of Normanby in the spring of 1975. The costs shown for this township are also 1975 costs extrapolated to a twelve month period.

The cost of collection varied from $2.82 to $5.22 per capita year for those municipalities with contracted disposal services. The cost of collection for the Town of Chesley and the Village of Neustadt includes the cost of supervision of the disposal sites as well. For the other municipalities, the supervision of the disposal sites is a separate expense covered in the cost of disposal.

The cost estimates for the private domestic collection services were in the range of $8 - $10 per household-year. Exact figures pertaining to the number of residents per household serviced with private collection were not available.

When reviewing collection costs, it should be noted that the costs are subject to the influence of several parameters including population density, the equipment used, haulage distance, and fluctuations in operating costs.

The disposal sites for each of the municipalities are also outlined in Table 2 - 1. With the exception of Formosa, all the solid waste generated in the study are is disposed of in the study area. Formosa residents use the Teeswater disposal site under an agreement arranged by the Township of Carrick. The Town of Walkerton has an agreement for the use of the Hanover Disposal Site.

The Township of Carrick has two disposal sites. The Village of Mildmay and about 1900 Township of Carrick residents use the disposal site near Mildmay; approximately 600 township residents use the disposal site near Carlsruhe.

TABLE 2 - 1

COLLECTION FIRMS AND 1974 COLLECTION COSTS

(Domestic and Commercial refuse)

| Municipality | Collection Firm | 1974 Cost $/Capita Year | Disposal Site |
|---|---|---|---|
| **Towns** | | | |
| Hanover | Grey - Bruce | 3.07 | Hanover |
| Walkerton | Grey - Bruce | 3.15 | Hanover |
| Chesley | McLellan | 4.50 | Twp. of Elderslie |
| **Villages** | | | |
| Mildmay | Halin | 2.39 | Twp. of Carrick |
| Neustadt | Seip | 2.82 | Neustadt |
| Paisley | Cormack | 5.22 | Paisley |
| **Townships** | | | |
| Bentinck | None[1] | ---- | Twp. of Bentinck |
| Brant | None[2] | ---- | Twp. of Brant |
| Carrick | None[3] | ---- | Twp. of Carrick (2 sites) |
| Elderslie | McLellan | 4.08[5] | Twp. of Elderslie |
| Greenock | None[4] | ---- | Twp. of Greenock |
| Normanby | McLellan | 4.59[6] | Twp. pf Normanby |

1. Some private collections for residents just north and east of Hanover
2. Elmwood and Marl Lakes have private collection
3. Formosa solid waste goes to Teeswater Site
4. Cargill and Chepstow have private collection
5. Collection commenced June of 1974
6. 1975 Cost

## 2.2 LOCATION AND PHYSICAL CHARACTERISTICS OF EXISTING DISPOSAL SITES

The information on existing disposal sites was obtained through interviews with the municipal clerks, site operators, the solid waste haulers and by several visits to each site.

Virtually all solid waste in the study area is disposed of in sanitary landfill sites. A map indicating the locations of the disposal sites is shown in Figure 2 - 1. Each location is designated by an identity letter.

The physical characteristrics of each site were reviewed and summarized. They include:

(1) Dryness Classifications - refers to workable area only, does not include swampy portions of total site,
Good - free of ground and surface water problems
Fair - seasonal wetness
Poor - presence of water most of year.

(2) Topography - of the workable area,
- undulating, hillside (hill), flat.

(3) Soil Type - sand, clay, loam, gravel,

(4) Natural Screening - poor, fair, good
- as seen from nearest group of houses or road,

(5) Cover Material - poor, fair, good
- availability of material on site and adaptability of material for winter operation.

Several of the physical characteristics are related for many of the disposal sites. For example, the soil type can influence the cover material rating. Clay material is difficult to move in the winter; thus it receives a lower cover material rating even though it may be present in abundance. The topography and the natural screening are often related. Flat sites with few trees are often visible to the public unless artificial screening barriers are erected.

TABLE 2 - 2

PHYSICAL CHARACTERISTICS OF EXISTING DISPOSAL SITES

| Municipality Served[1] | Dryness | Topography | Natural Screening | Soil Type | Cover Material Rating |
|---|---|---|---|---|---|
| **Towns** | | | | | |
| Hanover-Walkerton (G) | fair | undulating | fair | sand-clay | fair |
| Chesley (C) | fair | flat | poor | clay-loam | fair |
| **Villages** | | | | | |
| Mildmay (I) | good | hill | poor | sand-stones | good |
| Neustadt (J) | good[2] | hill | fair | clay-loam | poor |
| Paisley (B) | fair[2] | hill | fair | clay | fair |
| **Townships** | | | | | |
| Bentinck (F) | good[2] | flat | good | sand | good |
| Brant (E) | fair[2] | hill | good | gravel-clay | fair |
| Carrick (H) | good[2] | hill | fair | sand | good |
| Elderslie (A) | f-g[2] | undulating | good | clay | poor |
| Greenock (D) | fair[2] | undulating | good | clay-till | fair |
| Normanby (K) | fair | undulating | good | gravel-till | good-fai |

1. letters in brackets refer to site identification letter on map

2. subject to seasonal wetness.

The summary of the physical characteristics of the landfill sites within the study area is given in Table 2 - 2. The operating area of most of the sites is fairly dry, although several sites were subject to seasonal wetness problems. The Township of Elderslie location was free of groundwater problems but surface runoff was found to be filling the trenches as well as disrupting daily operations at the site. The natural screening at five sites was good. The operations at the disposal sites serving Chesley and Mildmay were clearly visible from the nearest group of houses and the municipal roads respectively. However, operations at these sites were being maintained in an aesthetically pleasing manner.

The landfill sites that had an on-site supply of sand have the highest cover material rating. Sand is found to be usable in the winter while other soil types are difficult to move once frozen. The Neustadt site material rating was poor because all cover material had to be imported onto the site. Previous inspections by this office revealed that the quality of the cover material being imported onto the Neustadt site was such that it did not lend itself to a good winter operation.

## 2.3 SOLID WASTE VOLUMES RECEIVED AT EXISTING SITES

Consultant with municipal clerks, landfill site operators and collection firms helped in the formation of the amount of solid waste delivered and the number of persons using each of the disposal sites within the study area.

The complete summary of these findings is presented in Table 2 - 3. All figures present are for 1974 with the exception of the Township of Normanby which began operation at the present site in early 1975. A review of Table 2 - 3 indicates that the Hanover disposal site (G), dominated the study area in terms of waste quantities received. The total population using the Hanover disposal site was officially 9,522 people or about 35 per cent of the total population within the study area. However, the waste received at the site represented 70 percent of the total solid waste generated in the study area. As discussed earlier in Section 1.2, this disproportionately high percentage of solid waste was felt to be due to a number of factors.

TABLE 2 - 3

DISPOSAL SITE SIZES AND VOLUMES RECEIVED

1974

| Municipality Served[1] | Population Served[2] | Site Size[3] (acres) | Waste Rec'd (T/yr) | Life Expectancy[4] (Years) |
|---|---|---|---|---|
| **Towns** | | | | |
| Hanover-Walkerton(G) | 9522 | 80 (25) | 10,430 | 5 |
| Chesley (C) | 1755 | 10 (5) | 580 | 5-8 |
| **Villages** | | | | |
| Mildmay (I) | 2905 | 5 (4) | 720 | 5 |
| Neustadt (J) | 531 | 9.2 (3) | 170 | 5-8 |
| Paisley (B) | 947 | 1.0 (0.5) | 310 | 1 |
| **Townships** | | | | |
| Bentinck (F) | 2360 | 50 (35) | 520 | 20 |
| Brant (E) | 2542 | 20 (5) | 600 | 5-8 |
| Carrick (H) | 600 | 2 (2) | 140 | 3-5 |
| Elderslie (A) | 1250 | 6.3 (2.7) | 300 | 8-10 |
| Greenock[5] (D) | 2622 | 100 (55) | 580 | 15 |
| Normanby[5] (K) | 2491 | 82 (7) | 550 | 15 |

1. letters in brackets refer to site identification letter on map
2. accounts for inter-township and township-municipality arrangements in 1974
3. estimate of usable area in brackets
4. projection based on current operation and volumes received
5. 1975 estimates.

(1) Higher per capita generation of domestic and commercial solid waste for the Towns of Hanover and Walkerton,
(2) Industrial waste deposited at the Hanover disposal site,
(3) Use of the site by non-residents of Hanover and Walkerton.

The population using the Township of Carrick-Mildmay site (I), was estimated at 1002 residents from the Village of Mildmay and 1903 residents of the Township of Carrick. The Township of Carrick Carlsruhe site (II) was estimated to be the disposal site for 600 township residents.

It was estimated that approximately one quarter of the population of the Township of Brant use the Township of Greenock disposal site. Adjustments were made in the population presented in Table 2 - 3 for each of these townships to account for this fact.

The life expectancies of each of the existing landfill sites within the study area were calculated based on an appraisal of the usable space at the site and an estimate of the volume of waste projected to be deposited at the site in the future based on 1974 information. The life expectancy does not include the possibility that activities at the site may have to be curtailed prior to the site reaching its projected capacity. Environmental problems such as leachate entering or threatening to enter the groundwater could seriously reduce the future use of any site. Few sites in the study area have been closely studied by a hydrogeologist. This factor should be noted when reviewing the discussions regarding future operations.

## 2.4 EXISTING DISPOSAL SITES OPERATIONS AND COSTS

Information was gathered on the operating characteristics of each disposal site. This information was then tabulated along with the annual operating costs for each location and summarized in Table 2 - 4.

TABLE 2 - 4

EXISTING DISPOSAL SITE OPERATIONS AND COSTS FOR 1974

| Municipality | Comp.-Cover Operation hrs/week | Supervision[1] hrs/week | 1974 Cost | Unit Costs[2] $ per Capita-year | $ per Ton-year |
|---|---|---|---|---|---|
| **Towns** | | | | | |
| Hanover-Walkerton[3] | 51 | ---- | 35,347 | 3.71 | 3.39 |
| Chesley[4] | 2* | ---- | 1,950 | 11.11 | 3.36 |
| **Villages** | | | | | |
| Mildmay[5] | 4.2 | 17 | 5,502 | 1.89 | 7.64 |
| Neustadt[4] | 1 | ---- | 840 | 1.58 | 4.94 |
| Pailsey | 3* | 7.5 | 2,820 | 2.98 | 9.10 |
| **Townships** | | | | | |
| Bentinck | 1 | 16 | 4,328 | 1.83 | 8.32 |
| Brant[6] | 3.5* | 16 | 4,760 | 1.87 | 7.93 |
| Carrick[7] | 1.8 | 9 | 2,776 | 4.63 | 19.82 |
| Elderslie | 0.3 | (2) | 424 | 0.34 | 1.42 |
| Greenock[6] | 4.0 | 18 | 5,096 | 1.94 | 8.79 |
| Normanby[8] | 3.5 | 8 | 4,294 | 1.72 | 7.82 |

* estimated

1 brackets indicate weekly average, not hours every week

2 based on tonnage and population figures outlined in Table 2 - 3

3 supervision + cover - compaction performed by one man

4 supervision included in collection costs

5 per capita costs include part of Township of Carrick population

6 Township Brant - Township of Greenock Agreement (see text)

7 serves 600 residents only

8 1975 costs.

The costs presented in Table 2 - 4 are those costs encountered for site supervision, covering and compaction, trench digging, pest control services, and general office expenditures. The costs do not include disposal site rental or annual costs reflecting an amortized payment on the initial capital cost of the disposal site.

All the municipalities within the study area with the exception of the Township of Bentinck contracted out the work for covering and compaction. The Township of Bentinck purchased a crawler tractor to be used part time at their disposal site.

The relatively large amounts of solid waste deposited at the Hanover site requires an extensive cover and compaction operation. In addition, higher costs for supervision, planning and general office expenditures contribute significantly to the overall costs. In 1974, the operation of the disposal site was under the guidance of one man who carried out both the covering and compaction duties as well as the site operation.

The Hanover disposal site had the second highest cost on a per capita basis but the third lowest cost on a per ton basis of any of the disposal sites in the study area. The difference between the costs can be mainly attributed to the difference in the per capita generation of waste in the Towns of Hanover and Walkerton as well as a more efficient use of equipment at the disposal site.

The Chesley disposal site cost of operations represented one of the lowest costs of any of the municipalities. The reason for this is that the cost of supervising the site is incorporated into the collection costs. In addition, the site was open to the public only one day per month in 1974 which is significantly below the average of all the municipalities. The Villages of Mildmay uses the Township of Carrick disposal site near Mildmay and paid approximately half the operating costs of the disposal site in 1974. The cost breakdown on a per capita basis includes the number of residents of the Township of Carrick using the site plus the Mildmay residents.

The costs presented in Table 2 - 4 for the Village of Neustadt were representative of the 1974 costs for importing cover material and for the cover and compaction operation. The supervision of the site is included as part of the collection service provided by Mr. Seip.

The operating costs for the Village of Paisley are indicative of the higher costs encountered when a relatively small population is operating its own disposal site. The costs per capita and per ton are considerably higher than those for most of the other municipalities.

The costs presented for the Township of Bentinck are for the fiscal year from June 1974 to June 1975. The largest portion of expenditures was attributable to the site supervision. As mentioned earlier, the disposal site equipment is owned by the township.

The Township of Brant pays the Township of Greenock one quarter of the operating costs of the disposal site serving the Township of Greenock for the use of its site by residents living in the western portion of the Township of Brant. The cost breakdown on a per capita basis for the Township of Brant is based on a population of three quarters of the population of the township. The per capita cost for the Township of Greenock is based on the township population of the Township of Greenock plus on quarter of the population of the Township of Brant.

The cost of operating the Township of Carrick disposal site near Carlsruhe was the highest cost on a per capita and a per ton basis of all of the municipalities in the study area. The disposal site is used by approximately 600 township residents and the higher costs reflect a well-run but small-scale disposal site operation.

The costs of operating the disposal site serving the Township of Elderslie are the extrapolated costs for 1975 based on the costs of the first half of 1975. The disposal site operation was not meeting the minimum requirements of operation for cover and compaction as outlined by the Ministry of the Environment. However, at a subsequent meeting with township officials in the latter part of 1975, the township indicated that the operation of the disposal site would soon be upgraded.

The present disposal site serving the Township of Normanby commenced operation in early 1975. The costs presented in Table 2 - 4 are those encountered for the first half of 1975 and extrapolated through to the end of the year.


Figure 2-1 LOCATION OF CERTIFIED LANDFILL SITES WITHIN THE STUDY AREA

# 3.0 ALTERNATIVE FORMS of WASTE DISPOSAL

## GENERAL

In the past, waste disposal was carried out in a rather uncontrolled fashion with generally little awareness of the occurrence of air, land and water pollution. In recent years, especially since the enactment of the Waste Management Act, 1971, controlled disposal of waste through sanitary landfilling techniques has significantly reduced the occurrence of pollution problems. Of course, some waste disposal sites established prior to the carrying out of site evaluations before commencing use may still pose a threat to ground water contamination until leachate production has creased. While sanitary landfilling is considered on environmentally acceptable means of waste disposal, it is recognized that garbage is a resource and as such should not be merely discarded in sanitary landfill but reused when possible.

In this section, the primary alternatives to sanitary landfill are presented. Some of these methods have proven to be suitable in other locations throughout North America. A brief outline of the principles of each method and the applicability of the process to the study area is given.

## 3.1 RECYCLE AND RESOURCE RECOVERY

Disposal methods in which recycle and resource recovery play a significant role have recently become the focus of attention throughout Ontario.

The terms "recycle" and "resource recovery" are worthy of definition.

Recycle: The recovery of some portion of solid wastes for re-use in the same product.

Resource Recovery: The recovery of some portion of solid wastes for re-use in a different form from the waste items themselves.

Re-cycling may occur naturally (water cycle) or artificially as in the case of man-made reprocessed articles (glass bottles). Resource recovery may take forms such as heat recovery from combustibles or glass mixed with asphalt as a road material.

### 3.1.1 Past Restrictions

To date the use of resource recovery in conjunction with solid waste disposal has been restricted primarily because it has been largely an uneconomical process. Two of the major economical reasons for the slow resource recovery acceptance are:

1. large capital and operating expense of the processing plant facilities,

2. uncertaintly of the marketability of the recovered materials.

The contaminated and mixed nature of the waste collected by municipal governments requires a wide range of sophisticated separation equipment. For example, specialized equipment must be used to recover paper products, ferrous metals, non-ferrous metals, plastics, glass and organic fuels. The technology is still in the experimental stage for some of the recovery methods while other processes require further research to produce a more uniform product.

The markets for various recovered materials have been difficult to predict for any given time period. The economic laws of supply and demand dictate the sale of recovered materials. The type, quality and quantity of the materials to be sold is solely dependent on the market for that material. For example, if the recovered product was sold to an industry whose process utilized recovered material, the market for that recovered material would fluctuate with the market demand for that industry's product.

### 3.1.2 Recycling Efforts

In the past several citizen action groups have taken the initiative by separating refuse at the source, namely in the household. Unfortunately, the success of most of these endeavours has been marginal and non-permanent. Difficulties in obtaining and maintaining markets have been due to the inability to maintain a steady supply of high quality product. In addition, market fluctuations have caused the programmes to be temporarily or permanently halted.

Home separation of materials such as paper, tin cans, glass etc. has been attempted with subsequent separate collection or transportation directly to a salvage dealer or a primary industry. The results generally show that, excluding labour, the transportation costs for individual delivery of the products results in a very high material cost. Even where separate collections for each of the commodities occurred the collection costs have been shown to be greater than the market rate. Studies have also shown that even if people initially offer to sort their garbage, very few continue this practice over the long term.

The best method of re-cycling seems to be mechanical sorting at the municipal level after collection, with perhaps some pre-sorting of paper by the householder at the source.

### 3.1.3 Need for Resource Recovery and Recycling

The time is approaching when society cannot afford to throw away as waste large quantities of certain types of materials. Indeed many industries in the study area have started to utilize some of these materials which were previously considered waste. However, the quantity of waste continues to increase each year and the costs for establishing a suitable disposal method are continuing to rise. For example, sanitary landfill costs are increasing due to the increase in land and equipment costs. In addition, the availability of suitable land near the municipalities, is becoming scarce. This results in higher transportation and labour costs.

The increased difficulty in obtaining suitable landfill sites is not confined just to the larger urban centres. Past disposal operations where poor housekeeping and open burning have been predominant have resulted in strong opposition in some areas by the public to establishing new landfill sites. This is not to say that waste disposal by sanitary landfilling can not be environmentally acceptable, but certainly the need to explore alternatives is apparent.

### 3.1.4 Provincial Plan

The Ontario Ministry of the Environment has expressed the opinion that recycling and resource recovery is the long term solution to the municipal waste management problems.

A number of separate waste management programs have been integrated into a single comprehensive Provincial program. The program is designed to provide both short and long-term solutions to problems such as the development of the technology and new markets. The ultimate aim is to provide a method of disposal not just for the metropolitan areas, but for municipalities of all sizes.

The Ontario Government is working in co-operation with Metropolitan Toronto in undertaking the design and construction of an experimental reclamation pilot plant. The research is to be directed toward the separation of the refuse into its component fractions and the marketing of these recycled commodities. In addition, a program has been set up whereby a number of "front-end" recycling plants are to be constructed in the Province. These "front-end" processing plants will remove for sale a proportion of readily separable and marketable material such as paper, paper products, and ferrous metals. The program covers three, five-year stages.

#### Stage 1

Between 1975 and 1980, waste management systems throughout the Province will be improved to replace the number of disposal sites by transfer stations and concentrate disposal operations in a few, large sophisticated facilities. At the central facilities serving major population centres "front-end" processing plants will be installed.

#### Stage 2

Between 1980 and 1985, the provision of transfer stations and transportation networks should be completed throughout the province, which will enable the remainder of the "front-end" plants needed to be constructed.

Work on the installation of proven "back-end" recovery processes should commence during this stage. The term "back-end" includes the recovery of non-ferrous metals, glass, plastics and organic and fibre fuel.

Stage 3

Between 1985 and 1990, it is hoped that a complete resource recovery process will serve 90 percent of the population of the province.

### 3.1.5 The Study Area and the Resource Recovery Plan

At this stage, the resource recovery plan is just developing. It is felt that it will be unlikely that the waste generated within the study area will be recovered at a "front-end" plant within the next ten years. However, a co-operative approach to the local solid waste problem should be initiated within the next ten years, in preparation for the eventuality of a resource recovery operation.

## 3.2 INCINERATION

Incineration is a high temperature process whereby the volume of suitable municipal refuse may be reduced significantly.

In reviewing the application of incineration as a means of disposal in the study area, two methods of incineration were examined. The methods were municipal incineration and rural incineration.

### 3.2.1 Municipal Incineration

Municipal incinerators have been in use in North America for many years. In areas where suitable land is not available for landfill, incineration may be a feasible alternative. However, the capital and operating costs are high. For an incinerator to be comparable to other forms of disposal a large unit of at least 200 tons per day would be needed. Thus, municipal incineration is usually more economically feasible in large urban centres.

The demands placed on the other utilities by a municipal incinerator are important factors in the selection of incineration as a means of disposal. These demands contribute significantly to the capital and operating costs of municipal incinerators. The demands include:

1. Electric power needed for fans, pumps, cranes and pollution control equipment,

2. Water supply needed for cooling the ash, pollution control equipment, domestic uses, firefighting and washdowns; the water demand can vary from 350 - 2,000 gal/ton of waste,

3. Sanitary sewers required for all waste waters,

4. Fuels needed for plant start-up and heating,

5. Communication equipment,

6. Snow removal equipment.

Municipal incineration does not eliminate sanitary landfill requirements. Materials such as logs, tree stumps, mattresses, furniture, tires, signs, steel frames and appliances still need disposal as well as the ash from the incinerator. In fact, ash and non-combustibles which are not incinerated can comprise up to 40 to 50 percent of the total refuse collected.

Heat recovery from municipal incineration is becoming more attractive as the price of natural fuels increase. However, this process is more suitable for large urban areas where markets for the recovered heat are available and the high costs for the heat recovery equipment can be more readily recovered.

The 1974 cost of a municipal incinerator to be set up and operated in an urban location and designed to serve the study area was estimated to be in excess of $750,000.00, not including the price of the land. The operating costs in terms of manpower, capital equipment amortization, services, etc. were estimated to be over $25/ton of solid waste.

Therefore, because of the high capital and operating costs, municipal incineration-sanitary landfill operation is not recommended for the area of study at this time.

### 3.2.2 Rural Incinerators

Most of the rural incinerators are batch-type incinerators. They have a lower capital cost and are easier to operate, than municipal incinerators. However, these units often have high maintenance costs and tend to emit high levels of pollutants. Because of the high air pollution emissions, they cannot be located near residential dwellings. A remote site location is essential. This is expected to add considerably to the costs of haulage. As was the case with municipal incineration, the rural incinerators do not eliminate the requirements for a sanitary landfill site. They are not flexible in handling the various types of waste and unless supervision of the operation is continuous, problems such as equipment breakdowns and waste backlogs could be expected.

The operation of a rural incinerator unit to serve the area of study was considered to be initially a single shift operation and later, as the waste load increased, upgraded to a two-shift operation. The construction cost for such a unit, including ancillaries, but excluding land costs was estimated to be in excess of $150,000.00.

The operating costs in terms of power, staff, equipment depreciation, maintenance and administration were estimated to be over $10/ton of solid waste material. This cost estimate did not include the cost of landfilling the incinerator ash and the bulky non-combustibles.

The establishment of a rural incinerator-sanitary landfill operation is not recommended at this time because of the relatively high operating costs as compared to just a sanitary landfill operation.

## 3.3 PYROLYSIS

Pyrolysis is a process in which organic material is heated to a high temperature ($1000^{O}$ - $2000^{O}$ F) in either an oxygen free or low-oxygen atmosphere. The high temperature and lack of oxygen result in a chemical breakdown of the organic materials into three components:

(1) gas consisting of hydrogen, methane, carbon monoxide and carbon dioxide,

(2) a "tar" "oil" which includes organic chemicals such as acetone and methanol,

(3) a char consisting of almost pure carbon plus any inerts such as glass, metals and rocks.

Pyrolysis is considered one of the most advanced waste treatment techniques but applications to solid waste are limited. It is still in the development stage and is not recommended as a treatment alternative.

## 3.4 COMPOSTING

Compost is a humus-like material, which results from the aerobic biological stabilization or digestion (at temperature of $150^{o}$ to $170^{o}$ F) of the biodegrable materials in solid waste.

The major benefit of compost is its use as a soil conditioner. Compost will: (1) improve soil structures, (2) increase moisture holding capacity, (3) reduce leaching of soluble inorganic nitrogen, (4) increase the phosphorus availability to growing plants and (5) increase the buffering capacity of the soil.

It is not a fertilizer and contains only a small portion of the major fertilizer nutrients nitrogen, phosphorus, and potassium.

Most systems employ various types of size reduction and separation equipment to salvage material such as glass, metal and newsprint and to upgrade the quality of the compost produced.

A compost plant merits study if suitable tracts of land are not available for landfilling purposes. This was the situation in the Regional Municipality of Sudbury where a 300 ton per day compost plant was recommended.

The capital and operating costs of a composting system are high. In addition, markets for the composted material have to be established if the process is to be economically feasible. The necessity of such a system and the economical potential of composting in the study area are dubious. As a result, this system is not recommended for the study area.

## 3.5 DISCUSSION

The alternative waste disposal methods to sanitary landfilling outlined in this section for the solid wastes generated in the study area require a large capital investment, require more manpower to operate and generally are not felt to be applicable to the study area at this time.

Incineration would require a large capital investment with the reduction in the sanitary landfill requirements not justifying its recommendation at this time. Pyrolysis is still in the early stages of development. Composting is an established method of disposal but the need for compost material in the study area is questionable and the costs are high.

Resource recovery is an attractive form of disposal. However, the various recovery processes are not yet fully developed. It is expected that during the next ten years many of the technological problems will be solved. It is also expected that firm markets will be established for the recovered materials and a final government plan will be established for the Province of Ontario. Thus in the long run, resource recovery is scheduled to be the future form of disposal for most of the communities in Ontario including the study area. However, a resource recovery process using the waste generated in the study area is highly improbable within the next ten years.

To serve the study area for the immediate future, it is felt that a sanitary landfill operation remains the most viable method of disposal. If the operation of a sanitary landfill site were a co-operative effort among several of the municipalities within the study area, it would establish a firm base for the implementation of a future resource recovery program.

## 4.0 ECONOMIC EVALUATION OF CENTRALIZING DISPOSAL OPERATIONS

### GENERAL

A review of the eleven disposal sites serving the twelve communities in the study area indicates that only one site (Township of Bentinck) is in a location that will be able to serve its needs for ten years or more based on the information at hand. Although the life expectancies of the disposal sites serving the Township of Elderslie, Greenock and Normanby are projected to be over eight years, the presence of ground water and surface water runoff is known to reduce the efficient operation of these sites on occasion. As stated earlier, the life expectancy of any of the existing disposal sites may be significantly reduced if hydrogeological data gathered in the coming years indicates that problems with groundwater contamination have developed or could develop due to the unsuitability of the location of the site. In the absence of hydrogeological information, the approximate year that the other municipalities will be seeking a new disposal site is estimated to be as follows:

Village of Paisley 1976,
Township of Carrick (Carlsruhe Site) 1978-1980
Town of Hanover and Walkerton 1980
Township of Carrick (Mildmay Site) 1980
Township of Brant 1980-1983
Town of Chesley 1980-1983
Village of Neustadt 1980-1983

By 1980, most of the municipalities in the study area will seriously be looking for new disposal sites. Some of the cost factors that each municipality would probably encounter in their search for a new site will be outlined. It was felt that a comparison between the cost factors for individual municipalities establishing their own disposal sites and one large central disposal operation serving all the municipalities would help to determine the feasibility of each method. To facilitate such a comparison, it was assumed that not all municiaplities would be looking for new disposal sites in the same year.

The costs reviewed include the expected capital costs to obtain, evaluate and prepare individual disposal sites as well as one central disposal operation. Similarly, operating costs were calculated for all disposal sites. The operating costs included expenses for site supervision, cover and compaction and management that would be typical of a well operated site providing good service to its residents. The higher cost of delivering the solid waste to a central disposal site due to the greater haulage distances was also calculated for each municipality.

The year 1974 was chosen as the reference year for all cost calculations. Therefore, it should be noted that all costs presented represent a conservative estimate.

The size of each disposal site was calculated on the basis that it would be used for 10 years. A period of use longer than 10 years was not considered because of the activity with the development of the Provincial Recovery Program that may directly affect the study area.

## 4.1 CAPITAL COST ESTIMATES

The primary costs in obtaining, evaluating and preparing a sanitary landfill site are as follows:

1. Land Acquisition,
2. Geological-Hydrological Assessment,
3. Site Preparation,
4. Management.

### 4.1.1 Land Acquisition

The amount of land required for a new disposal site was determined for each individual municipality within the study area with the exception of Hanover and Walkerton. The Towns of Hanover and Walkerton were assumed to be depositing their waste at a common site. In addition, the amount of land which would serve as a central disposal site was also determined. It was assumed that all solid waste generated within the study area could be accommodated at such a site.

TABLE 4 - 1

CAPITAL COSTS[1] ESTIMATES TO OBTAIN EVALUATE

AND PREPARE MUNICIPAL DISPOSAL SITES

(Based on 1974 Cost Data)

| Municipality | Land Req'd Acres | Land Cost $ | Hydrological Geological Cost $ | Preparation Costs[2] $ | Management Costs[3] $ | Total Cost $ |
|---|---|---|---|---|---|---|
| **Towns** | | | | | | |
| Hanover & Walkerton | 135 | 135,000 | 15,000 | 19,000 | 8,000 | 177,000 |
| Chesley | 10 | 10,000 | 5,000 | 5,000 | 1,000 | 21,000 |
| **Villages** | | | | | | |
| Mildmay | 6 | 6,000 | 3,000 | 4,000 | 1,000 | 14,000 |
| Neustadt | 5 | 5,000 | 1,000 | 4,000 | 1,000 | 11,000 |
| Paisley | 5 | 5,000 | 3,000 | 4,000 | 1,000 | 13,000 |
| **Townships** | | | | | | |
| Bentinck | 9 | 9,000 | 6,000 | 5,000 | 2,000 | 22,000 |
| Brant | 10 | 10,000 | 8,000 | 5,000 | 1,000 | 24,000 |
| Carrick | 10 | 10,000 | 6,000 | 5,000 | 1,000 | 22,000 |
| Elderslie | 5 | 5,000 | 4,000 | 4,000 | 1,000 | 14,000 |
| Greenock | 7 | 7,000 | 5,000 | 4,000 | 1,000 | 17,000 |
| Normanby | 10 | 10,000 | 6,000 | 5,000 | 1,000 | 22,000 |
| Totals | 212 | 212,000 | 62,000 | 64,000 | 19,000 | 357,000 |
| Central Disposal Site | 192 | 192,000 | 18,000 | 23,000 | 12,000 | 245,000 |

1. All costs rounded off to nearest $1,000.00

2. Includes drainage, access roads, fencing

3. 5% of all other costs, minimum $1,000.00.

In determining the amount of land needed, a compaction of 800 lbs/cu. yd. was used for the two larger disposal sites (the site serving Hanover and Walkerton and the central disposal site). The smaller disposal sites which would not have the benefit of a daily compaction and cover operation were assumed to have a compaction of 600 lbs/cu. yd. The operating depth in all cases was assumed to be two yards. The waste tonnages generated in 1974 were used as the basis for all calaculation.

A factor of 2.5 was applied to the calculated land requirements to account for future population growth, higher unit solid waste generation rates, cover material volumes and storage area. The total area was doubled again to account for land that could not be used for landfilling purposes due to hydrological and/or geological reasons. An adequate buffer zone which would allow proper screening as well as an area for gas migration would also be included in this factor. Each site was assumed to require a minimum of 5 acres of land.

An initial purchase price of $1,000. per acre was felt to be represntative of the cost of land which would be generally suitable for sanitary landfilling purposes. With proper management, the land was expected to be returned to active use after the ten year period. The possible uses of former sanitary landfill sites are known to include parkland, farming and grassland for cattle grazing. It was assumed that all municipalities would choose their disposal sites with the possible use of the land after the ten year disposal period as one of the major factors in their original choice.

### 4.1.2 Geological-Hydrological Assessment

Prior to the selection of any disposal site, several parameters relating to the geology of the selected area have to be assessed. On site soil horizons should be identified and an estimate of existing proportion of each soil type should be made. This is an important consideration due to the necessity of having a workable soil in the winter for cover application. Excavation problems can also be avoided.

A hydrogeological report is necessary to avoid pollution of ground and/or surface water by leachate emanating from the refuse. A report should include a study of nearby well records, test drilling and an on-site drainage evaluation. The Ministry of the Environment may assist smaller municipalities in carrying out a hydrogeological investigation to determine site suitability but generally recommend that consultants be retained to provide this service. Usually, the municiaplity is required to dig test holes, using a backhoe.

For sites serving less than 1,500 people, the Ministry inspection may be all that is required. However, if there is an expressed public concern or if the site is to serve more than 1500 people, the application for approval must be submitted to the Environmental Assessment Board at a public hearing. This in most cases necessitates the retaining of a consultant, to conduct the hydrogeological investigations and prepare site development and operation plans.

For each municipality, it is difficult to know precisely what studies would have to be undertaken at any given location or the number of sites that may have to be examined. Nevertheless, a cost range of $1,000.00 to $15,000.00 was felt to approximate the expected costs. The minimum cost for sites serving more than 1,500 people was estimated to be $5,000.00 because of the possibility of consulting services being required.

### 4.1.3 Site Preparation

#### Roads

Well-located and properly constructed roads are essential to develop and control site locations. The main access road should be built to withstand all weather conditions.

#### Fencing

The construction of a fence to enclose the entire site is necessary to prevent illegal dumping, burning and scavenging. It also excludes most domestic and some wild animals whose entry might create a public health hazard.

Drainage

Drainage ditches may be necessary to prevent surface water runoff from interfering with the disposal practices and being contaminated with leachate.

Access Control

The control of access to the landfill site will require the use of a main gate capable of being locked and appropriately marked signs.

### 4.1.4 Management

The cost of overseeing the entire operation by municipal officials or a management board was included under this heading. The costs include salaries, postage, special notices and public hearings. The costs may also include obtaining options for land acquisition and legal fees. For the larger sites, the services of a consulting engineering firm may be required.

### 4.1.5 Capital Cost Summary

The estimated capital cost to obtain, evaluate and prepare selected disposal sites for each of the municipalities as well as for a centrally located disposal site based on 1974 cost data are outlined in Table 4 - 1. It should be noted that these are estimates only and actual costs may differ.

The central disposal site is expected to require 192 acres of land if it is to be used by the municipalities within the study area during the next ten years. On the other hand, if each municipality was to use its own disposal site, a total of 212 acres of land would be required.

Considerably lower capital cost expenditures would be required if all the municipalities were to establish a central disposal site. As shown in Table 4 - 1, the formation of a central disposal site used by all the municipalities in the study area is estimated to cost approximately $245,000.00. However, if each municipality were to establish its own disposal site, the estimated capital costs would total $357,000.00. The primary area of savings for the central disposal site is through the elimination of the duplication of the hydrological-geological assessment ($54,000.00) and the site preparation costs ($41,000.00).

## 4.2 OPERATING COST EVALUATION

The operating costs were calculated for the individual disposal sites as well as for the centralized disposal site. In calculating the costs; however, assumptions had to be made to ensure a uniform operating procedure. The assumptions made were as follows:

1. The disposal site would be open each Saturday every week to accommodate the public.

2. Residential and commercial disposal carried out by collection firms would take place on a day other than Saturday.

3. The townships with no collection services would be open to the public two days per week.

4. Each site must have an attendent present when the site is open.

5. An earth cover would be applied in a manner that conforms to the following guidelines for all village and town disposal sites.

| Population | Cover Application |
|---|---|
| 500 | once per month |
| 1000 | twice per month |
| 1500 | once per week |
| 2500 | twice per week |
| 3500+ | daily. |

The Townships of Bentinck, Brant, Carrick, Elderslie, Normanby were allowed to apply an earth cover once per week. The Township of Brant, serving the largest population of all the townships was assumed to be covering their solid waste twice per week.

6. The cover and compaction operation would be for a minimum of 4 hours and on a contract basis. (This would ensure that the contractor was receiving a fair return on his time and investment).

TABLE 4 - 2

ESTIMATED OPERATING COSTS[1] FOR MUNICIPAL DISPOSAL SITES

(Based on 1974 Cost Data)

| Municipality | Supervision $/year | Cover Compaction $/year | Management[2] $/year | Total $/year |
|---|---|---|---|---|
| **Towns** | | | | |
| Hanover-Walkerton | 8,000 | 42,400 | 5,000 | 55,400 |
| Chesley | 2,500 | 3,300 | 600 | 6,400 |
| **Villages** | | | | |
| Mildmay | 2,500 | 1,700 | 400 | 4,600 |
| Neustadt | 2,500 | 800 | 300 | 3,600 |
| Paisley | 2,500 | 1,700 | 400 | 4,600 |
| **Townships** | | | | |
| Bentinck | 2,500 | 3,300 | 600 | 6,400 |
| Brant | 2,500 | 6,600 | 900 | 10,000 |
| Carrick | 2,500 | 3,300 | 600 | 6,400 |
| Elderslie | 2,500 | 3,300 | 600 | 6,400 |
| Greenock | 2,500 | 3,300 | 600 | 6,400 |
| Normanby | 2,500 | 3,300 | 600 | 6,400 |
| Totals | 33,000 | 73,000 | 10,600 | 116,600 |
| Central Disposal Site | 8,000 | 42,400 | 5,000 | 55,400 |

1. All costs rounded off to nearest 100 dollars.

2. 10% of supervision and cover-compaction costs.

7. The disposal site serving Hanover and Walkerton as well as the centralized site would be a two man, 6 day per week operation.

8. Management costs would account for 10 per cent of all other operating costs and would include costs attributable to rodent control, advertising, postage and municipal supervision of controls and finances.

### 4.2.1 Operating Costs Summary

A summary of the estimated annual operating costs based on 1974 costs for all the municipalities in the study area as well as for a centralized disposal site are presented in Table 4 - 2.

The operating costs for a disposal site serving only the Towns of Hanover and Walkerton and a central disposal site serving all the municipalities in the study area were expected to be the same. It is expected that a more efficient use could be made of the manpower and equipment at a central site. This greater degree of efficiency would offset the higher amount (15 Tons/day) of solid waste received at the central disposal site.

The Township of Brant was expected to have the highest operating costs of all the townships primarily due to a higher population and the need for a more extensive cover and compaction operation.

In summary, the operating costs for all the municipalities in the study area operating their own disposal sites is estimated to be $116,600.00 based on 1974 costs. If the same municipalities were served by a central disposal site, the annual operating costs are estimated to be $55,400. Operating costs can be expected to increase at a rate of 8 - 10 per cent per year.

## 4.3 TOTAL ANNUAL DISPOSAL SITE COST SUMMARY

The estimated amortized capital costs and the estimated annual operating costs for all the municipalities were added together to determine the total annual disposal site costs. The results are presented in Table 4 - 3.

TABLE 4 - 3

ESTIMATED TOTAL ANNUAL MUNICIPAL DISPOSAL SITE COSTS

(Based on 1974 Costs Data)

| Municipality | Amortized* Capital Cost $/year | Operating Cost | Total Annual Cost $/year |
|---|---|---|---|
| Towns | | | |
| Hanover-Walkerton | 28,100 | 55,400 | 83,500 |
| Chesley | 3,300 | 6,400 | 9,700 |
| Villages | | | |
| Mildmay | 2,200 | 4,600 | 6,800 |
| Neustadt | 1,700 | 3,600 | 5,300 |
| Paisley | 2,100 | 4,600 | 6,700 |
| Townships | | | |
| Bentinck | 3,500 | 6,400 | 9,900 |
| Brant | 3,800 | 10,000 | 13,800 |
| Carrick | 3,500 | 6,400 | 9,900 |
| Elderslie | 2,200 | 6,400 | 8,600 |
| Greenock | 2,700 | 6,400 | 9,100 |
| Normanby | 3,500 | 6,400 | 9,900 |
| Totals | 56,600 | 116,600 | 173,200 |
| Central Disposal site | 38,900 | 55,400 | 94,300 |

* Amortized at 10 per cent interest over 10 years.

A review of Table 4 - 3 indicates that over 65 per cent of the total annual cost for each disposal site is attributable to the operating costs. The disposal sites that would be expected to receive the greatest amount of solid waste material are also expected to have proportionally higher costs.

If each municipality developed its own disposal site the total annual cost is estimated to be $173,200. based on 1974 cost data. However, if a central disposal site were to serve all the municipalities in the study area, the total annual cost is estimated to be $94,300. Operating costs can be expected to increase at 8 - 10 per cent per year.

## 4.4 ECONOMIC EVALUATION OF COLLECTION COSTS

It was assumed that if the municipalities in the study area were to establish individual disposal sites, these sites would be approximately within the same area as those presently used. As a result, no increase in haulage costs due to an increased haulage distance would be realized. However, in the event of a central disposal site being established, some municipalities would be expected to have higher collection costs due to the extra haulage distance to the central site.

A centralized disposal site would have to be located near those centres where the largest amount of solid waste is generated to minimize transportation costs. This would place the location of such a disposal site between the Towns of Hanover and Walkerton. To carry out the economic evaluation, it is assumed that land could be obtained in this area that would be suitable for a sanitary landfill operation. No investigations were carried out to confirm this assumption.

The additional haulage distance to the centralized disposal site from each of the disposal sites serving each of the municipalities within the study area is presented in Table 4 - 4. The determination of the extra haulage costs was based on a twenty cubic yard truck containing 4.5 tons of municipal refuse and costing one dollar per mile to and from the central disposal site. The number of loads per week and the number of miles per load were then used to compute the overall increase or decrease in the annual haulage costs. The haulage costs included all waste collected regardless of its origin or the collection firm involved.

TABLE 4 - 4

ECONOMIC EVALUATION OF COLLECTION COSTS

| Municipality | Solid Waste Tons/Year | Loads[1] No/Year | Extra[2] Miles/ Load | Additional Costs[3] Year |
|---|---|---|---|---|
| Towns | | | | |
| Hanover-Walkerton | 10,430 | 2,318 | --- | --- |
| Chesley | 580 | 129 | 28 | 3,610 |
| Villages | | | | |
| Mildmay | 310 | 69 | 19 | 1,310 |
| Neustadt | 170 | 38 | 16 | 610 |
| Paisley | 310 | 69 | 40 | 2,760 |
| Townships | | | | |
| Bentinck | 520 | 116 | 22 | 2,550 |
| Brant | 800 | 178 | 12 | 2,140 |
| Carrick | 550 | 123 | 15 | 1,850 |
| Elderslie | 300 | 67 | 35 | 2,350 |
| Greenock | 380 | 85 | 32 | 2,720 |
| Normanby | 550 | 123 | 28 | 3,440 |

1 based on a 4.5 T load

2 round trip

3 based on $1/mile.

The disposal site for each of the townships was assumed to be centrally located within each township. To calculate the increased haulage costs, the distance from the centre of each of the towns and villages or the townships to the central disposal site was used regardless of the availability of collection service. However, to obtain cost data on haulage to a central disposal site, it was assumed that the residents of each municipality were supplied with collection services.

Table 4 - 4 does not indicate any additional haulage costs for the Towns of Hanover and Walkerton. It was felt that with the disposal site located between these municipalities, any additional haulage costs that would be realized by one town would be offset by the haulage savings of the other town.

The Village of Paisley and the Township of Elderslie would encounter the longest additional return haulage distance of 40 and 35 miles respectively. The Town of Chesley and the Township of Normanby would realize the largest increase in the solid waste haulage cost.

## 4.5 ECONOMIC EVALUATION SUMMARY

The overall estimated cost benefits of a central site were calculated to determine the feasibility of all municipalities in the study area participating in such an undertaking.

The proportion of the total expenses of operating a central disposal site were estimated for each municipality based on the weight of the solid waste generated by that municipality. The solid waste of unknown origin generated in the Hanover-Walkerton area (see section 1.2) was assumed to be generated by Hanover and Walkerton for each of calculations.

The estimated cost benefits of each municipality participating in a centralized disposal site are presented in Table 4 - 5. For each municipality, the proportional costs of its participation in a central disposal site was determined. The difference between that cost and the higher cost expected if the municipality ran its own disposal site was calculated and referred to as the gross savings. The increased haulage costs to the cental disposal site were subtracted from the gross savings to obtain the net annual savings for collection and disposal realized by the municipality participating in the centralized disposal site.

TABLE 4 - 5

ESTIMATED COST SHARING AND BENEFIT ANALYSES OF A CENTRAL DISPOSAL SITE

| Municipality | Solid Waste % of Total | Proportional Cost of a Central Site ($) | Cost if Not a Central Site ($) | Gross Annual Saving ($) | Increased Haulage Costs ($) | Net Annual Savings ($) |
|---|---|---|---|---|---|---|
| **Towns** | | | | | | |
| Hanover-Walkerton | 70.0 | 66,000 | 83,500 | 17,500 | -- | 17,500 |
| Chesley | 3.9 | 3,700 | 9,700 | 6,000 | 3,610 | 2,390 |
| **Villages** | | | | | | |
| Mildmay | 2.1 | 2,000 | 6,800 | 4,800 | 1,310 | 3,490 |
| Neustadt | 1.1 | 1,000 | 5,300 | 4,300 | 610 | 3,690 |
| Paisley | 2.1 | 2,000 | 6,700 | 4,700 | 2,760 | 1,940 |
| **Townships** | | | | | | |
| Bentinck | 3.5 | 3,300 | 9,900 | 6,600 | 2,550 | 4,050 |
| Brant | 5.4 | 5,100 | 13,800 | 8,700 | 2,140 | 6,560 |
| Carrick | 3.7 | 3,500 | 9,900 | 6,400 | 1,850 | 4,550 |
| Elderslie | 2.0 | 1,900 | 8,600 | 6,700 | 2,350 | 4,350 |
| Greenock | 2.5 | 2,300 | 9,100 | 6,800 | 2,720 | 4,080 |
| Normanby | 3.7 | 3,500 | 9,900 | 6,400 | 3,440 | 2,960 |
| Totals | 100.0 | 94,300 | 173,200 | 78,900 | 23,340 | 55,560 |

The amount of the savings varied considerably among the municipalities. The Towns of Hanover and Walkerton realized the greatest net savings of $17,500 per year. The Town of Chesley, the Village of Paisley and the Township of Normanby realized the lowest net savings, primarily because of the higher increases in haulage costs compared to the other municipalities.

Overall, the annual net savings to all municipalities within the study area is expected to exceed $55,000. if all the municipalities participate in a centralized disposal site.

## 4.6 DISCUSSION

The results of the economic evaluation as presented in this section indicate there would be a definite economic advantage if all the municipalities within the study area were to participate in a central disposal operation. The estimated costs of operation as presented may be found by some municipalities to be higher than that which is presently experienced. However, the costs are felt to represent a well run operation that provides a good service to the residents of each of the municipalities and disposes of waste in an environmentally acceptable manner.

The formation of a central disposal site to serve all the municipalities in the study area will undoubtedly appeal to some municipalities more than others. Any municipality that presently does not provide collection service for its residents would have to consider introducing such a service if it participated in a central disposal site which was felt to be an inconvenient distance from most of its residents.

The municipalities considered as most probable partners in a central disposal site include the Towns of Hanover and Walkerton, the Villages of Paisley and Mildmay and the Townships of Carrick and Brant. The Towns of Hanover and Walkerton are considered key participants due to the volumes of refuse generated in the municipalities. The Village of Paisley will require a new disposal site before the end of 1976 and will soon have to consider the possibility of obtaining a new site or sharing a disposal site with a neighbouring municipality. The Village of Mildmay will require a new site by 1980 and is well within an economic haulage distance to a central site if the central site were located near Hanover and Walkerton. Similarly, the Townships of Brant and Carrick may find that the central disposal site may be within an economical distance for its residents.

The other municipalities within the study area may consider either that the distance to a central site is beyond their limits for convenience, or that the consideration of obtaining a new disposal site at this time is a low priority in their municipal responsibilities. However, they should be represented at preliminary meetings.

The participation of several municipalities in a central disposal site is not an unusual occurrence. For example, the solid waste disposal site in the nearby Township of Minto serves as the disposal site for the Towns of Harriston and Palmerston and the Village of Clifford in addition to the Township of Minto. Similarly, the disposal site serving the Township of Holland also serves the Villages of Markdale and Chatsworth.

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